WHAT IS CLAIMED IS:

1. A system for calculating an air-fuel ratio of each cylinder of an internal combustion engine, in which a plurality of exhaust passages connected to the respective cylinders are merged together at an exhaust collecting portion and an air-fuel ratio sensor is arranged at the exhaust collecting portion, for calculating an air-fuel ratio of each cylinder based on a sensor detection signal from the air-fuel ratio sensor, the system comprising:

means for calculating an air-fuel ratio at the exhaust collecting portion by receiving the sensor detection signal from the air-fuel ratio sensor;

means for calculating a gas flow rate at the exhaust collecting portion based on a gas flow rate history of each cylinder;

means for calculating a fuel quantity at the exhaust collecting portion from the calculated air-fuel ratio at the exhaust collecting portion, and the gas flow rate also at the exhaust collecting portion, as a burnt fuel quantity corresponding thereto;

means for constructing an observer using a fuel quantity of each cylinder as a variable by a model in which the fuel quantity at the exhaust collecting portion is associated with the fuel quantity of each cylinder, and estimating the fuel quantity of each cylinder from the result of observation by the observer; and

means for calculating an air-flow ratio of each

cylinder from the fuel quantity of each cylinder thus estimated.

2. The system for calculating an air-fuel ratio of each cylinder of an internal combustion engine according to claim 1, wherein

the model in which the fuel quantity at the exhaust collecting portion is associated with the fuel quantity of each cylinder is a model in which the fuel quantity at the exhaust collecting portion is associated as a weighted average of a fuel quantity history of each cylinder.

3. The system for calculating an air-fuel ratio of each cylinder of an internal combustion engine according to claim 1, wherein

the fuel quantity of each cylinder is estimated by a Kalman filter type observer.

4. The system for calculating an air-fuel ratio of each cylinder of an internal combustion engine according to claim 1, wherein

the gas flow rate at the exhaust collecting portion is calculated by using a model in which a gas flow rate for each cylinder is associated with the gas flow rate at the exhaust collecting portion.

5. The system for calculating an air-fuel ratio of

each cylinder of an internal combustion engine according to claim 4, wherein

the gas flow rate at the exhaust collecting portion is calculated by using a model in which a weighted average of the gas flow rate history of each cylinder is associated as the gas flow rate at the exhaust collecting portion.

6. The system for calculating an air-fuel ratio of each cylinder of an internal combustion engine according to claim 1, further comprising:

means for compensating a phase delay of the sensor detection signal sent by the air-fuel ratio sensor, to calculate the fuel quantity at the exhaust collecting portion based on output from the compensating means and the gas flow rate at the exhaust collecting portion.

7. A system for calculating an air-fuel ratio of each cylinder of an internal combustion engine in which exhaust gases from respective cylinders are merged at an exhaust collecting portion, an air-fuel ratio at the exhaust collecting portion is detected by an air-fuel ratio sensor, and an air-fuel ratio of each cylinder is calculated based on a sensor detection signal from the air-fuel ratio sensor, wherein

the air-fuel ratio at the exhaust collecting portion is calculated based on the sensor detection signal and a gas flow rate history of each cylinder, and

an observer using the air-fuel ratio of each cylinder as a variable is constructed by a model in which the air-fuel ratio at the exhaust collecting portion is associated with the air-fuel ratio of each cylinder, to estimate the air-fuel ratio of each cylinder based on the result of observation by the observer.

8. The system for calculating an air-fuel ratio of each cylinder of an internal combustion engine according to claim 7, wherein

the air-fuel ratio at the exhaust collecting portion is calculated by using a sensor model for compensating a phase delay of the sensor detection signal output by the air-fuel ratio sensor.

9. The system for calculating an air-fuel ratio of each cylinder of an internal combustion engine according to claim 8, wherein

the system is applied to a multicylinder internal combustion engine utilizing an intake control system capable of controlling an intake air quantity of each cylinder.

10. The system for calculating an air-fuel ratio of each cylinder according to claim 9, wherein the system is applied to a fuel injection control system of a multicylinder internal combustion engine to feedback control the fuel injection quantity of each cylinder by using the

air-fuel ratio of each cylinder obtained.